

APPARATUS, SYSTEM, AND METHOD FOR DOWN-CONVERTING  
AND UP-CONVERTING ELECTROMAGNETIC SIGNALS

ABSTRACT OF THE DISCLOSURE

Methods, systems, and apparatuses for down-converting and up-converting an electromagnetic signal. In embodiments, the invention operates by receiving an electromagnetic signal and recursively operating on approximate half cycles of a carrier signal. The recursive operations can be performed at a sub-harmonic rate of the carrier signal. The invention accumulates the results of the recursive operations and uses the accumulated results to form a down-converted signal. In embodiments, up-conversion is accomplished by controlling a switch with an oscillating signal, the frequency of the oscillating signal being selected as a sub-harmonic of the desired output frequency. When the invention is being used in the frequency modulation or phase modulation implementations, the oscillating signal is modulated by an information signal before it causes the switch to gate a bias signal. The output of the switch is filtered, and the desired harmonic is output.

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